DOCUMENT RESUME

ED 110 972 CS 002 126

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TITLE Content and Sequence for Block I of the 1970 Reading Program.
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SPONS AGENCY Office of Education (DHEW), Washington, D.C.
PUB DATE 69
NOTE 17p.

EDRS PRICE MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS *Content Reading; Dictionaries; *Language Skills; Primary Education; *Reading Instruction; *Reading Programs; Reading Research; Reading Skills; Vocabulary Development; *Word Lists

ABSTRACT

Previous work has led to identification of an extensive lexicon on which the Southwest Regional Laboratory (SWRL) 1970 primary-grade reading program will be based, as well as to the development of a considerable number of sound-symbol correspondence rules (see Berdiansky, Cronnell, and Koehler, 1969). The present document describes the initial steps taken in the development of a complete sequencing of these rules. This sequencing procedure is being based, in general, on the Desberg and Cronnell (1969) analysis of the characteristics of the rules. For the first block of this sequence, the rules were ordered primarily on the basis of their combined productivity, i.e., the number of words from the given lexicon which can be generated by the given combination of rules. The sequencing of rules and the listing of resultant usable words is covered in this report for the first block of rules only. Within- and across-block sequencing has not yet been entirely completed. (Author)

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DM9
DATE: April 17, 1969
RELEASE: Howard J. Sullivan

CONTENT AND SEQUENCE FOR BLOCK I OF THE 1970 READING PROGRAM
Betty Berdiansky and George Stanton

Previous work has led to identification of an extensive lexicon upon which the SWRL 1970 primary-grade reading program will be based, as well as to the development of a considerable number of sound-symbol correspondence rules (see Berdiansky, Cronnell, and Koehler, 1969). The present document describes the initial steps taken in the development of a complete sequencing of these rules. This sequencing procedure is being based, in general, on the Desberg and Cronnell (1969) analysis of the characteristics of the rules. For the first block of this sequence, the rules were ordered primarily on the basis of their combined productivity, i.e., the number of words from the given lexicon which can be generated by the given combination of rules. The sequencing of rules and the listing of resultant useable words is covered in this report for the first block of rules only. Within- and across-block sequencing has not yet been entirely completed.

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The Desberg and Cronnell paper categorizes grapheme-phomene rules of correspondence into 17 sequenced blocks according to classification and sequencing rationales described by the authors of the paper. These rationales will not be discussed in this report at any greater length than is necessary to indicate the reasoning behind specific modifications of the Desberg and Cronnell sequence. Following are the steps gone through by the staff in their decisions on rule sequencing.

Step 1. The Desberg and Cronnell paper combined consonant rules, primary vowel rules, and secondary vowel rules into homogeneous groupings (Blocks). The Block I consonant rules: S10, N10, M10, R10, L10, T10, D10, P10, B10, and the Block I primary vowel rules: I15, A15, E15, U15, O15, (the "short vowels") were selected and assigned to initial blocks because of their high frequency and regularity. The initial block of the secondary vowel rules consisted only of Rule EE10. It was designated to Block I because it was the most regular secondary vowel rule, although the second most frequent. In the earliest stages of this program, rule regularity was seen as more crucial than rule frequency.

Step 2. The Rule 15 printout for each vowel and the Rule EE10 printout were consulted, and those words which were composed of only those vowels and consonants comprising Block I were listed. Also, the "40-words" sub-group ("40 words" are words containing at least one irregular grapheme - phoneme correspondence) for each of these regular vowel rules was examined, and a separate list was made of words containing a Block I grapheme's 40 rule in addition to the regular Block I rules. Then the I40, A40, E40, U40, O40, and EE40 printouts were consulted, and words containing the assigned consonants and vowels operating under Block I regular or 40 rules were listed. Only the vowel-rule

printouts had to be consulted, since they included all the words which would have been in any of the consonant-rule printouts. Given below is an example of the format used for listing the words selected from the printouts:

A15				A40	
non-40s		40s		1 syl.	2 syl.
1 syl.	2 syl.	1 syl.	2 syl.		

Step 3. For each vowel-rule, a cumulative chart was constructed, (i.e., each word entry occurs as soon as all component letters of the word are listed, but not before). This chart used the Desberg and Cronnell consonant Block I sequence: S, N, M, R, L, T, D, P, B; which was based on the idea that, since continuants blend easier than stops, it would be best to use them at the outset of instruction. The chart showed the order of occurrence of these words which could be taught from the Block I vowel and Block I consonant rules. It also showed the rules prerequisite to teaching a given word, provided the rules were taught in this order. For example, for the primary vowel Rule 015, the cumulative list of possible words from the consonant-10 rules S, N, M, R, L, and T was as follows:

	non 40s		40s		040s	
	1 syl.	2 syl.	1 syl.	2 syl.	1 syl.	2 syl.
S						
N						
M	mom					
R						
L					sol	
T	lot, not rot, slot tot, trot	tom-tom				

Step 4. When charts for all vowel-15 rules, with the consonants ordered S, N and so forth, were inspected, the resulting words-per-rule ratio was quite low in the early steps of the sequence. As a first step in leading to the construction of a more productive sequence, the number of words in which each of the nine consonants occurred with each of the six vowels was determined. This information would be useful in developing the most productive order of rule introduction, since no cumulative restrictions would be placed on the count of consonant vowel pairs. Therefore, the following list was constructed:

	Total	I15	A15	E15	U15	O15	EE10**
*H10	25	6	4	6	7	2	
S10	112	21	27	24	25	6	9
N10	76	14	22	22	13	5	
M10	64	14	14	10	21	5	
R10	63	12	11	6	20	6	8
L10	86	26	15	22	9	8	6
T10	129	25	33	28	24	15	8
D10	76	12	20	19	6	11	8
P10	113	27	27	15	20	16	8
B10	60	7	16	10	16	7	4
	359	(71)	(80)	(64)	(67)	(40)	(27)

Since the words covered by Block I rules have just one vowel apiece, each word contributed a tally in the appropriate vowel column for each different consonant it contained. For example, the word "smart" would contribute a tally in each of the following four cells of the A15 column: A-S, A-M, A-R, and A-T. Summing across a row gives the number of words in which that consonant occurs,

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*The rule H10 was added to Block I, although it was not in the original Desberg and Cronnell sequence, because SH and TH rules are scheduled for Block II. It was felt the Block I should contain, S, T and H rules separately before their introductions as digraphs.

**It was later decided to move the EE10 rule into Block II, although it was included in Block I when this matrix was constructed.

since the words in this group had no more than one vowel. If a word repeated any consonants, only one tally, not two, was given to that particular consonant vowel combination. According to the "total" column of this matrix, the rank order of consonant rules, according to the frequency of their occurrence with all of the vowels in Block I, is: T10, P10, S10, L10, N10, D10, M10 R10, B10, H10. Similarly, the number of words in which each vowel rule occurred was counted. These figures are circled at the bottom of each column. (The circled numbers are not the sums of the columns. The sums would equal the number of times each vowel occurred with every other letter in each word of the lexicon.) The resulting rank order for the vowels was A15, I15, U15, E15, O15 and EE10. When individual cells in the matrix were rank ordered the result was: TA; TE; SA and PA; PI; LI and SU; SE; TI; SI, NA, NE and TU; LE, MU, RU and PU; DA and DE; BA; LA, BU and PO; TO; NI, MI, MA and PE; RI and NU; DI, RA and DO; BE.

Step 5. The most frequent consonants and vowels were then chosen from the consonant-vowel matrix. The rank order of the appearance of these consonants and vowels was also considered, since these two manners of ranking the consonants and vowel in terms of productivity might give different results, hence requiring certain adjustments.

The primary vowel rules A15, I15 and E15 were both the most productive and the highest in rank order of appearance. Therefore, a chart was made which showed for each vowel the number of Block I words which could be formed by that vowel combined with one, two, or three specified Block I

consonants.* (Five-letter combinations--i.e., 4 consonants-1 vowel--were not considered since they were relatively infrequent.) Charts 1, 2 and 3 give the results of this procedure (See Appendix A). The number following some of the consonant combinations in Charts 1, 2 and 3 indicates the number of words possible using that combination with that chart's vowel.

Step 6. Three more charts were made, based on the data from the first three. These new charts first listed the two-consonant, one-vowel combinations which, according to the first chart for that vowel, were combinable into the largest number of words. These initial combinations were then combined with each of the other most productive consonant rules for that same vowel. Thus, three-consonant, one-vowel combinations were established for all of the most productive consonants for a given vowel. (See Charts 4, 5 and 6 in Appendix A).

Step 7. The words for the most productive two-consonant, one-vowel combinations were listed and compared. They were:

N10, T10, A15 - ant, tan, at, an
L10, T10, I15 - ill, it, lit, till
N10, P10, I15 - nip, in, inn, pin

It had been decided, on the basis of efficency in maximizing productivity at this early stage, to include two vowels in the first unit. Thus, each of the above lists were expanded to include both A15 and I15, and the

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*At this point, it should be noted, that, for various reasons -- the most common being low anticipated utility--the following words were deleted from those under consideration: sop hell hemp pent rend smelt apt ass ban blab brad brat rat-tat tam tat lust mum pun rum rump sup trump dill din lisp pip primp spit. These deletions did not, however, affect the positions of A10, I10 and E10 as the most productive primary vowel rules.

following lists were compared:

N10, T10, A15, I15 - tin, tint, ant, tan, at, an, in, inn, it
L10, T10, A15, I15 - ill, at, it, till, lit
N10, P10, A15, I15 - an, in, inn, nap, pan, pin, nip

The combinations of N10, T10, A15 and I15, within this lexicon, proved to be the most productive and were therefore designated as Unit 1.

Step 8. For Unit 2, the most productive remaining consonant rules: S10, P10, L10 and D10 were each considered in combination with Unit 1. The following word lists resulted:

S10 - sat, sin, sit, its
P10 - pan, nap, pat, tap, pant, pit, tip, pin, nip
L10 - lit, ill, till, lint
D10 - and, did

Thus, P10 was designated as Unit 2.

Step 9. For Unit 3, vowel Rule E15 and the remaining most productive consonant rules (L10, S10 and D10) were considered. The most productive pair was sought. This was, by far, L10 and S10. This pair, when combined with N10, T10, P10. A15 and I15, yielded 40 new words. D10 and E15 then became Unit 4.

Step 10. The remaining rules (M10, B10, H10, R10, O15 and U15) needed to be combined in a reasonable way for Units 5 and 6. The rules M10, B10, and U15 were designated Unit 5, the others as Unit 6. This resulted in a rather even split of the block's remaining words, with Unit 6 containing a few more than Unit 5. The final organization of rules and word exemplars for Block 1 is presented in Appendix B.

APPENDIX A

FREQUENCY COUNTS FOR BLOCK I RULES IN COMBINATION

Chart 1: Consonant - combination frequencies for I15 words in Block I

T: 1	S	P	L: 1	N: 2	B: 1	D: 1	M	H	R
TS: 1	ST: 1	PT: 2	LT: 2	NT	BT: 1	DT	MT: 1	HT: 1	RT
TP	SP: 1	PS	LS: 1	NS	BS	DS	MS: 1	HS	RS
TL	SL	PL	LP: 2	NP: 2	BP	DP: 1	MP: 1	HP: 1	RP: 1
TN: 2	SN: 1	PN	LN	NL	BL: 1	DL	ML	HL: 1	RL
TB	SB	PB	LB	NB	BN: 1	DN	MN	HN	RN
TD	SD	PD	LD: 1	ND	BD: 1	DB	MB	HB	RB: 1
TM	SM	PM	LM: 1	NM	BM	DM: 1	MD	HD: 1	RD: 1
TH	SH	PH	LH	NH	BH	DH	MH	HM: 1	RM: 1
TR	SR	PR	LR	NR	BR	DR	MR	HR	RH
TRL: 1	SLD: 1	PRM: 1	LMP: 1		BLS: 1	DRL: 1	MST: 1	HNT: 1	
TRM: 1	SLM: 1		LNT: 1			DRP: 1			
	SLP: 2		LST: 3						
TRP: 1	SNP: 2								

Chart 2: Consonant - combination frequencies
for A15 words in Block I

T: 1	S	P	L	N: 1	B	D: 2	M: 1	H	R
TS	ST: 1	PT: 2	LT	NT	BT: 2	DT	MT: 1	HT: 1	RT: 1
TP	SP	PS: 2	LS: 1	NS	BS: 1	DS	MS: 1	HS	RS
TL	SL	PL	LP: 2	NP: 2	BP	DP	MP: 1	HP	RP: 1
TN: 2	SN	PN	LN	NL	BL	DL	ML	HL	RL
TB	SB	PB	LB	NB:	BN	DN	MN: 1	HN	RN: 1
TD	SD: 1	PD: 1	LD: 1	ND: 1	BD: 1	DB: 1	MB	HB	RB
TM	SM	PM	LM	NM	BM	DM: 2	MD	HD: 1	RD
TH	SH	PH	LH	NH	BH	DH	MH	HM: 1	RM: 1
TR	SR	PR	LR	NR	BR	DR	MR	HR	RH
TRP: 1	SND: 1	PNT: 1	LMP: 1		BND: 1	DMP: 1	MST: 1	HND: 1	
	SLB: 1	PST: 3	LND: 1		BRN: 1				
	SLM: 1	PLN: 1	LST: 1		BRS: 1				
	SLP: 1								
	SNP: 2								
	STB: 1								

Chart 3: Consonant - combination frequencies
for E15 words in Block I

T	S	P: 1	L	N	B	B	M	H	R
TS	ST: 2	PT: 1	LT: 2	NT: 3	BT: 1	DT	MT: 1	HT	RT
TP	SP	PS	LS: 1	NS	BS	DS	MS: 1	HS	RS
TL	SL	PL	LP	NP	BP	DP	MP	HP	BP
TN	SN	NP: 1	LN	NL	BL: 1	DL: 2	ML	HL	RL
TB	SB	PB	LB	NB	BN	DN: 1	MN: 1	HN: 1	RN
TD	SD	PD	LD	ND: 1	BD: 1	DB	MB	HB	RB
TM	SM	PM	LM: 1	NM	BM	DM	MD	HD	RD: 1
TH	SH	PH	LH	NH	BH	DH	MH	HM: 1	RM
TR	SR	PR	LR	NR	BR	Dr	MR	HR	RH
—	—	—	—	—	—	—	—	—	—
	SND: 1	PLT: 1	LND: 1		BLT: 1	DNT: 2	MLT: 1	HLD: 1	RNT: 1
	SNT: 2	PST: 1			BND: 1	DRS: 1	MND: 1	HLP: 1	RST: 1
	SLD: 1	PRS: 1			BNT: 1				
	SML: 1				BST: 1				
	SPD: 1				BLD: 1				
	SPL: 1				BLS: 1				
	STM: 1								

Chart 4: Most frequent two- and three-letter combinations for 115 words in Block I

CONSONANT COMBINATION	NUMBER OF WORDS OBTAINABLE	CONSONANT-RULE ADDED	TOTAL NUMBER OF WORDS OBTAINABLE
PT	3	S	6
		L	8
LT	4	P	8
		S	10
TN	5	P	9
		S	8
		L	9
LP	3	S	7
		T	8
NP	4	T	9
		S	8
		L	7

Chart 5: Most frequent two- and three-letter combinations for A15 words in Block I

CONSONANT COMBINATION	NUMBER OF WORDS OBTAINABLE	CONSONANT-RULE ADDED	TOTAL NUMBER OF WORDS OBTAINABLE
PS	2	N	7
		T	9
		L	6
		M	5
		D	6
PT	3	N	9
		S	9
		L	5
		M	6
		D	6
PL	2	N	6
		S	6
		T	5
		M	5
		D	6
PN	3	S	7
		T	9
		M	6
		L	6
		D	7

Chart 5: For A15 - Continued

INITIAL COMBINATION	NUMBER OF WORDS OBTAINABLE	CONSONANT RULE ADDED	TOTAL NUMBER OF WORDS OBTAINABLE
NT	4	S	5
		L	4
		M	7
		D	7
		P	9
DM	5	N	8
		T	7
		L	6
		P	8
		S	7

Chart 6: Most frequent two- and three-letter combination for 115 words in Block I

INITIAL COMBINATION	NUMBER OF WORDS OBTAINABLE	CONSONANT-RULE ADDED	TOTAL NUMBER OF WORDS OBTAINABLE
TS	2	L	5
		N	6
		D	2
LT	2	S	5
		N	5
		D	4
NT	3	S	7
		L	5
		D	7
DL	2	S	4
		T	4
		N	5

APPENDIX B
WORD EXEMPLARS FOR UNITS OF BLOCK I

Unit 1

Rules: N10, T10, I15, A15

NN10 (Geminate consonants, wherever applicable, are included with the corresponding single consonant rule because they have the same pronunciation.)

Exemplars: it tin in inn tint an ant at tan

Unit 2

Rules: P10

Exemplars: nip tip pin pit nap pant pan pat tap

Unit 3

Rules: L10, S10, LL10, SS10

Exemplars: ill lint lip lit pill till lap pal plan plant its pass past sin sip sit snip spin snap span spat taps split spill slit slip slid sill list still lass last slant slap slat sat

Unit 4

Rules: D10, E15

Exemplars: did dip pad add and dad land lad lid end tend dent den sled spend sped send lend led dell pest test nest sell sent set spent step less slept spell let pelt net pen pep pet tent ten tell

Unit 5

Rules: U15, B10, M10

Exemplars: bud bulb bum bun bus bust but butt dull dump dust lump mud muss must nut plum plump plus pump pup slum spun stub stump stun stunt sub sum sun tub tut up upon ups us bed bell belt bend bent best bet bled blend bless elm hem melt men mend bib bid bill bin bit blimp bliss dim imp limp mill miss mist mitt slam stamp stab tab slim am bad band bass bat blast dam damp lamp mad man map mass mast mess

Unit 6

Rules: O15, R10, H10, RR10

Exemplars: bran brand brass had ham hand hat ram ran rat strand strap tramp drill drip hid hill him hint hip hit prim print rib rid rim rip strip trill trim trip burr burn drum hub hull hum hump hunt hurt hut purr rub run runt rust rut slurp spur strum strut trust turn urn blond blot bob bond doll dot drop hop hot lot mob mom mop nod not odd on plod plot pod pond pop pot prop rob rod romp rot slop slot sob sod spot stop tom-tom top tot trot dress held help hem hen press red rent rest

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